Accepted Manuscript

Nonlinear free and forced vibration analyses of axially functionally graded Euler-Bernoulli beams with non-uniform cross-section

Sümeyye Sınır, Mehmet Çevik, B.Gültekin Sınır

PII: S1359-8368(18)30274-9

DOI: 10.1016/j.compositesb.2018.04.061

Reference: JCOMB 5669

To appear in: *Composites Part B*

Received Date: 6 February 2018

Revised Date: 17 April 2018

Accepted Date: 27 April 2018

Please cite this article as: Sınır Sü, Çevik M, Sınır BGü, Nonlinear free and forced vibration analyses of axially functionally graded Euler-Bernoulli beams with non-uniform cross-section, *Composites Part B* (2018), doi: 10.1016/j.compositesb.2018.04.061.

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

ACCEPTED MANUSCRIPT

Nonlinear Free and Forced Vibration Analyses of Axially Functionally Graded Euler-Bernoulli Beams with Non-Uniform Cross-Section

Sümeyye Sınır[a,*], Mehmet Çevik[b], B. Gültekin Sınır[c]

[a] Graduate School of Sciences, Bilecik Şeyh Edebali University, Gülümbe Campus, Bilecik, TURKEY, sumeyye.sinir@bilecik.edu.tr

[b] Department of Mechanical Engineering, İzmir Katip Çelebi University, Çiğli Main Campus, İzmir, TURKEY, mehmet.cevik@ikc.edu.tr

[c] Department of Civil Engineering, Manisa Celal Bayar University, Şehit Prof. Dr. İlhan Varank Campus -Yunusemre, Manisa, TURKEY, gultekin.sinir@cbu.edu.tr

Abstract

Nonlinear free and forced vibrations of axially functionally graded Euler-Bernoulli beams with non-uniform cross-section are investigated. The beam has immovable, namely clamped-clamped and pinned-pinned boundary conditions, which leads to midplane stretching in the course of vibrations. Nonlinearities occur in the system due to this stretching. Damping and forcing terms are included after nondimensionalization. The equations are solved approximately using perturbation method and mode shapes by differential quadrature method. In the linear order natural frequencies and mode shapes are computed. In the nonlinear order, some corrections arise to the linear problem; the effect of these nonlinear correction terms on natural frequency is examined and frequency –response curves are drawn to show the unstable regions. In order to confirm the validity, our results are compared with others available in literature.

***Keywords*:** Functionally graded material Euler-Bernoulli beam, Nonlinear model, Vibration, Perturbation method, Differential quadrature method.

1. Introduction

Functionally Graded Materials (FGMs) are inhomogeneous composites made up of two different materials, generally a metal and a ceramic, with a smooth and predefined continuous variation of properties in axial (longitudinal) direction, transverse direction or occasionally in both directions. They were initially developed to remove the distinct interface

* Corresponding author. Tel: +90 228 214 1872. E-mail: sumeyye.sinir@bilecik.edu.tr

Download English Version:

https://daneshyari.com/en/article/7211900

Download Persian Version:

https://daneshyari.com/article/7211900

Daneshyari.com